

Monthly Vital Statistics

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Focus . . . Infant Utilization of Hospital Services

Fifty percent of infants receive extended newborn care or are taken to a hospital for inpatient or outpatient care (including emergency room care) at least once in the first year of life. Extended newborn care or later inpatient hospitalization other than normal newborn care was experienced by 23 percent of Medicaid and 13 percent of non-Medicaid infants. For 1993 this care resulted in charges of \$260 million for all infants and \$147 million for Medicaid infants.

The population for this report is Missouri resident live births. Excluded were the four percent of births that took place in out-of-state or military hospitals, or died within a week of birth. Services provided to these infants were studied linking patient abstract reports provided by hospitals to the Missouri Department of Health to the appropriate birth certificate. Over 93 percent of records could be linked. Hospital utilization data included are records for admissions or visits that took place within a year of birth, including all inpatient stays, except for newborn stays of less than seven days, and outpatient services including emergency room (ER) care, observation, outpatient surgery, CT scans, and magnetic resonance imaging. Two common outpatient services not included in this report are x-ray and laboratory services provided by a hospital on an outpatient basis, where the recipient was not an ER patient (e.g., a physician referral for chest x-rays).

Hospital services were classified as follows: 1) extended newborn stay (seven days or more; 2) inpatient readmission, defined as an inpatient hospitalization at any age following dismissal from hospital care after birth; 3) ER visits; and 4) all other outpatient visits. When an infant was transferred directly from one hospital to another (e.g., a premature infant born at a community hospital and transferred to a children's hospital), data from all hospitals were collated and the infant was considered to have a single hospitalization. Infants brought to the hospital as ER patients but admitted as inpatients were counted as both ER and inpatients; the same was true for other outpatient encounters that resulted in inpatient admission (5.3 percent of infant ER visits and 1.1 percent of other outpatient encounters resulted in inpatient admission).

In this report Medicaid statistics refer to Medicaid status at birth, as reported on the birth certificate. This is not totally reliable as an indicator of Medicaid status later in infancy, since infants can gain or lose Medicaid eligibility, but its use allows development of population-based statistics, and Medicaid status at birth is highly consistent with principal payment source listed in hospital records (85 percent agreement).

The number of admissions/visits by type of service, race, and Medicaid status are presented in Table 1, with the number of times each infant used each service. Extended newborn stays were required for 4,461 (6.2 percent) of 72,119 births, more frequently for black than white infants (10.2 vs. 5.3 percent), and for infants of mothers who were on Medicaid at birth than non-Medicaid infants (8.0 vs. 4.9 percent, respectively). Low birth weight (<2,500 g) infants accounted for over half of extended newborn stays.

There were 11,654 inpatient readmissions (16.2 per 100 births), with black, Medicaid, and low-birth-weight births more likely to be readmitted. Overall, 10.1 percent of infants born in 1993 were readmitted as inpatients one time in the first year of life and 2.3 percent more than once.

Emergency room visits were by far the hospital service most frequently used by infants. There were 71,195 ER visits, almost one per birth; 42 percent of infants were seen in an ER in the first year of life; 19.8 percent had one ER visit, 17.3 percent had 2-4 visits, and 5.0 percent were taken to emergency rooms five or more times within the first year.

There were 5,958 outpatient visits other than ER visits (8.3 per 100 births). This was the only service used more frequently by white than black infants, and with similar frequency by Medicaid and non-Medicaid infants.

Data on average and total charges, and average stay for inpatients, are also listed in Table 1. Extended newborn stays averaged 21.7 days and \$34,892 charge per stay, for a total of \$155.6 million in charges. Inpatient readmissions averaged 4.2 days and \$6,980 per stay, for a total of \$81.3 million in charges. ER visits cost \$219 on average, for a total of \$15.6 million; other outpatient visits averaged \$1,309 per visit, for a total of \$7.8 million. Inpatient readmissions were concentrated among younger infants; 48 percent of readmissions were for infants younger than 3 months and 70 percent for infants younger than 6 months. The age distribution for ER and other outpatient encounters was relatively even by age.

In addition to higher crude rates of inpatient and ER utilization for black and Medicaid infants, higher crude rates of inpatient readmission and ER visits were also observed for infants whose newborn hospitalization lasted seven days or longer (primarily low birth weight infants and infants with birth defects), firstborn infants, and infants whose mothers were less than 20 or unmarried, had education less than 12 years, had late or no prenatal care (beginning after the fourth month), smoked during pregnancy, or lived in rural areas (outside the St. Louis, Kansas City, Springfield, Columbia, St. Joseph, and Joplin metropolitan areas).

Because many of these factors are highly correlated, the tendency to use inpatient readmission and ER services was examined by multivariate logistic regression. In Table 2 the adjusted relative risk (RR) for one or more inpatient readmissions and that for one or more ER visits are presented for each variable listed above with a 95 percent confidence interval.

The factor associated with the highest RR of inpatient readmission was extended newborn stay. After adjusting for other covariates, infants whose initial hospitalization exceeded six days were 2.19 times as likely to have a subsequent admission than those with shorter stays. The risk factors next in importance for readmission were Medicaid status at birth (1.46) and rural residence (1.43). Black infants had an adjusted RR of 1.17, statistically significant but smaller than the crude difference between black and white rates. Statistically significant increased risks for readmission

were also found for infants of teen mothers (1.28); mothers with low education (1.28), unmarried mothers (1.17); and mothers who smoked during pregnancy (1.13). After adjusting for all other variables, firstborn infants had a lower risk of inpatient readmission (0.77, or 23 percent less likely to be readmitted), while late or no prenatal care was not a statistically significant risk factor for inpatient readmission, because the 95 percent confidence interval includes 1.0.

For ER visits, the highest RR was for Medicaid status at birth (3.09). Black infants were 57 percent more likely to be treated in an ER, and infants of teen mothers, unmarried mothers, and mothers with low education had RRs of 1.42-1.45. Maternal smoking in pregnancy was associated with a 30 percent higher risk for one or more ER visit, and extended newborn stays with a 21 percent increased risk. Small but statistically significant elevated risks were also seen for firstborn infants (1.05 RR) and rural residents (1.05). After adjusting for other covariates, infants of women receiving late or no prenatal care were less likely to be seen in an ER (0.86 RR, or 14 percent less likely).

Principal diagnosis for inpatient readmissions and ER visits is presented in Table 3. Respiratory system diseases accounted for 40.9 percent of inpatient readmissions, primarily upper respiratory infections, pneumonia, and influenza, and 10.6 percent of readmissions had infectious and parasitic disease principal diagnoses. The perinatal conditions diagnosis category included the principal diagnoses of 9.3 percent of infant readmissions; this category includes perinatal jaundice, prematurity, and respiratory conditions and infections specific to the perinatal period. Birth defects were the principal diagnosis for 6.8 percent of readmissions.

For emergency room visits, respiratory diseases were also the leading principal diagnosis (32 percent), followed by otitis media (20.2 percent). Infectious and parasitic diseases (8.6 percent) and digestive system disorders (8.2 percent) were also important causes of ER visits. Injuries and poisonings accounted for the 7.4 percent of ER visits, with 42 percent of these cases listing a fall as the cause of injury.

These data suggest many hospital encounters by infants are preventable, that in many cases the illness itself could be prevented, and in other cases a lower level of care could adequately meet the needs of sick infants.

Infants who begin life healthy have less need for hospital services in the first year of life, as evidenced by lower risk for inpatient readmission and ER visits among infants who did not require extended newborn stays. Low maternal age and education and unmarried status are associated with low birth weight and other indicators of newborn morbidity and also with later hospital utilization. Smoking during pregnancy (which may also indicate postnatal exposure to tobacco smoke) is certainly preventable, and is associated with increased newborn and later morbidity. That some infants' illnesses could have been treated in a physician's office at an earlier, less serious stage before an ER visit or inpatient hospitalization became necessary is a reasonable conjecture, but not demonstrable with available data.

The data suggest that for many hospital encounters, particularly ER visits, infants could have been treated in lower-level settings, such as physician's offices or urgent care centers. Study of the principal diagnoses assigned to ER visits indicates a high proportion are for routine and relatively minor conditions, such as otitis media and upper respiratory infection. Use of an emergency room rather than a lower-level care setting may reflect real or perceived lack of options for treatment, lack of a primary care provider, inability to pay for services in another setting, or over-estimation of the seriousness of an infant's illness. That Medicaid and uninsured persons tend to depend upon emergency rooms for routine, non-emergency care has been discussed elsewhere.¹ High readmission rates among infants in rural areas suggests that they have less access to some services that can be provided in outpatient settings in urban areas.

Data included in this report are for infants born in 1993. Since that time managed care, with its emphasis on obtaining services from a primary care provider, has become an increasingly common component of both Medicaid and private insurance plans. When data for more recent births become available, the effect of managed care can be studied, and may show significant changes in infant utilization of hospital services.

¹Gadomski, A, et al. Diverting Managed Care Medicaid Patients From Pediatric Emergency Department Use. *Pediatrics*. 95 (2): 170-177. 1995.

Table 1
Hospital Utilization by Infants by Type of Service, Race, Birth Weight, and Medicaid Status at Birth:
Missouri 1993 Birth Cohort

Rate per 100 births (Number)

	Extended Newborn Stay		Inpatient Readmission		Emergency Room Visit		Other Outpatient Visit	
Total Admissions/Visits								
Total	6.2	(4,461)	16.2	(11,654)	98.7	(71,195)	8.3	(5,958)
White	5.3	(3,105)	15.0	(8,737)	83.7	(48,775)	8.8	(5,122)
Black	10.2	(1,284)	22.0	(2,766)	170.3	(21,506)	6.0	(762)
Non-Medicaid*	4.9	(2,093)	11.4	(4,843)	44.0	(18,730)	8.2	(3,476)
Medicaid*	8.0	(2,353)	23.1	(6,776)	178.2	(52,331)	8.4	(2,464)
Normal birth	3.0	(2,428)	14.8	(9,883)	96.4	(64,492)	7.9	(5,290)

weight								
Low birth weight	46.5	(2,023)	33.9	(1,770)	128.4	(6,695)	12.8	(666)
<i>Admissions/Visits per Infant</i>								
None	93.8	(67,658)	87.6	(63,121)	58.0	(41,834)	93.0	(67,047)
1	6.2	(4,461)	10.1	(7,292)	19.8	(14,295)	6.3	(4,545)
2-4	--	--	2.2	(1,597)	17.3	(12,479)	0.7	(497)
5+	--	--	0.1	(99)	5.0	(3,511)	0.04	(30)
Average stay (days)	21.7		4.2		-		-	
Average charge	\$34,892		\$6,980		\$219		\$1,309	
Total charges (millions)	\$155.6		\$81.3		\$15.6		\$7.8	

*Medicaid status at birth. Source of data is the birth certificate.

Table 2
Adjusted Relative Risk for One or More Inpatient Readmission and Emergency Room (ER) Visits* for Selected Characteristics: Missouri 1993 Birth Cohort

		<i>Inpatient Readmission</i>		<i>Emergency Room Visit</i>	
	Total Births	Adjusted Relative Risk	95% Confidence Interval	Adjusted Relative Risk	95% Confidence Interval
Black	12,630	1.17	(1.09-1.25)	1.57	(1.50-1.65)
Extended newborn stay	4,461	2.19	(2.03-2.37)	1.21	(1.13-1.29)
Medicaid at birth	29,362	1.46	(1.38-1.55)	3.09	(2.97-3.22)
First born	28,961	0.77	(0.73-0.81)	1.05	(1.02-1.09)
<i>Maternal characteristics at birth</i>					
Rural resident	15,941	1.43	(1.35-1.51)	1.05	(1.01-1.09)
Age <20	10,257	1.28	(1.20-1.38)	1.45	(1.37-1.54)
Unmarried	23,655	1.17	(1.10-1.24)	1.44	(1.38-1.50)
Education <12	14,730	1.28	(1.20-1.35)	1.42	(1.35-1.49)
Late/no prenatal care	7,646	0.95	(0.88-1.02)	0.86	(0.82-0.91)
Smoker	16,025	1.13	(1.07-1.20)	1.30	(1.25-1.35)
Total births	72,119				

*Risk of one or more inpatient readmission or ER visit for listed characteristic in relation to births without that characteristic (e.g., risk for blacks compared to non blacks), after adjusting for all other listed characteristics, using multivariate logistic regression.

Table 3
Inpatient Readmissions and Emergency Room Visits by Principal Diagnosis:
Missouri 1993 Birth Cohort

	Percent of Total (Number)			
<i>Principal Diagnosis</i>	Inpatient Readmission		Emergency Room Visit	
All admissions	100.0	(11,654)	100.0	(71,195)
Infectious and Parasitic Diseases	10.6	(1,238)	8.6	(6,099)
Intestinal infectious diseases	2.7	(309)	1.7	(1,225)
Endocrine, Nutritional, Metabolic	3.9	(450)	0.4	(292)
Volume depletion	3.1	(361)	0.3	(227)
Nervous System & Sense Organs	3.3	(379)	22.7	(16,145)
Otitis media	1.2	(138)	20.2	(14,365)
Circulatory System	0.6	(72)	0.2	(145)
Respiratory System	40.9	(4,769)	32.0	(22,785)
Acute upper resp infections	22.0	2,566)	23.0	(16,145)
Pneumonia and influenza	14.3	(1,671)	3.6	(2,552)
Chronic bronchitis & asthma	3.3	(380)	2.5	(1,808)
Digestive System	7.2	(844)	8.2	(5,843)
Noninfectious gastroenteritis	2.5	(296)	4.9	(3,465)
Genitourinary System	2.6	(303)	0.7	(512)
Skin & Subcutaneous Tissue	0.9	(109)	3.1	(2,199)
Musculoskeletal	0.2	(26)	0.2	(131)
Congenital Anomalies	6.8	(789)	0.3	(186)
Perinatal Conditions	9.3	(1,082)	1.4	(996)
Perinatal jaundice	3.6	(414)	0.4	(265)
Ill-defined Conditions	8.7	(1,013)	9.1	(6,493)
Fever	2.9	(339)	2.7	(1,912)
Injury and Poisoning	3.3	(387)	7.4	(5,303)
Other & Unknown Diagnosis	1.7	(193)	5.7	(4,066)

Provisional Vital Statistics for January 1997

LIVE BIRTHS increased slightly in January as 7,142 Missouri babies were born compared with 6,963 one year earlier.

Cumulative births show a slight decrease for the 12 months ending with January. However, provisional calendar year 1996 data indicates a slight increase from 72,804 in 1995 to 73,600 in 1996.

DEATHS show little change between 1996 and 1997 figures. Provisional 1996 deaths total 53,600 compared with 54,222 in 1995.

The **NATURAL INCREASE** for Missouri in January was 1,418 persons (7,142 births minus 5,724 deaths). This represents a slight increase from 1,234 in January 1996.

MARRIAGES and **DISSOLUTIONS OF MARRIAGE** decreased in January and also for the 12 months ending with January. Provisional 1996 figures show 45,000 marriages and 26,400 dissolutions for a marriage to divorce ratio of 1.70.

INFANT DEATHS increased in January as 61 Missouri infants died compared with 39 in January 1996. The provisional infant death rate for 1996 was 7.5 per 1,000 live births compared with 7.4 in 1995.

Provisional Resident Vital Statistics for the State of Missouri

	January				12 months ending with January								Provisional		
Item	Number		Rate*		Number			Rate*				1996			
	1996	1997	1996	1997	1995	1996	1997	1994	1995	1996	1997	Number	Rate		
Live births	6,963	7,142	15.3	16.1	74,704	73,486	72,722	14.8	14.2	13.8	13.6	73,600	13.7		
Deaths	5,729	5,724	12.6	12.9	52,674	54,195	54,088	10.7	10.0	10.2	10.1	53,600	10.0		
Natural increase	1,234	1,418	2.7	3.2	22,030	19,291	18,634	4.2	4.2	3.6	3.5	20,000	3.7		
Marriages	2,835	2,657	6.2	6.0	45,013	45,977	44,728	8.4	8.5	8.6	8.3	45,000	8.4		
Dissolutions	2,629	2,080	5.8	4.0	25,853	26,419	26,225	5.1	5.0	5.0	4.8	26,400	4.9		
Infant deaths	39	61	5.5	7.2	600	534	578	8.6	8.0	7.3	7.9	550	7.5		
Population base (in thousands)	--	--	5,359	5,395	--	--	--	5,237	5,279	5,322	5,362	--	5,359		

*Rates for live births, deaths, natural increase, marriages and dissolutions are computed on the number per 1000 estimated population. The infant death rate is based on the number of infant deaths per 1000 live births. Rates are adjusted to account for varying lengths of monthly reporting periods.

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